



Population status of the Brown bear (*Ursus arctos*) in the Republic of Macedonia (project report)



**Project: "Development of the National
Ecological Network in the Republic of
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landbouw, natuur en
voedselkwaliteit



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Abbreviations

BLRP	Balkan Lynx Recovery Programme
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
ECNC	European Centre for Nature Conservation
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MEPP	Ministry of Environment and Physical Planning
MES	Macedonian Ecological Society
Mt.	Mountain
NEN	National Ecological Network
NGO	Non-governmental organization
NP	National park
SCALP	Status and Conservation of the Alpine Lynx Population

Summary

The Brown bear (*Ursus arctos* L.) is the largest of the carnivore species found in the Republic of Macedonia. Indeed, it is clear from surveys of public opinion that it enjoys considerable popularity in the country. It is a species with a number of habitat requirements, including a need for core areas of habitat that are connected to each other by ecological corridors, ideally set within traditionally managed landscapes dominated by grassland and grazing animals. In this respect, the presence of viable populations of bear can be indicative of general ecosystem health and the availability of conditions that will benefit large carnivores such as lynx and wolf, and a range of other animals and plants and the habitats within which they can prosper.

During the past two decades several projects and programmes have addressed the status and conservation of the Brown bear population in the Republic of Macedonia, led by the Macedonian Ecological Society in cooperation with other international organizations from the region and beyond. The result has been a compilation of more reliable data on the present status of the Brown bear population that will allow preparation of ground for the effective conservation and management of the species in the future.

The Macedonian Brown bears belong to the same nominal subspecies as the whole European Brown bear population. Once present all over the country, inhabiting lowland forests, flood plains and natural meadows, today the Brown bear population is restricted to the mountainous forest areas in the western, central and southern parts of the country. Both the restricted distribution and the decline of the population are a result of the intensive hunting, destruction and fragmentation of the bear's habitat and other disturbances by humans. The current population estimates vary between 160-200 Brown bears.

In 2008, MES in cooperation with ECNC-European Centre for Nature Conservation began a long-term project on the development of a National Ecological Network in Macedonia. The project aims to improve the development of the Macedonian National Ecological Network (NEN) as

part of the Pan-European Ecological Network. In doing so it aims to raise the profile of and to consolidate the existing protected areas within the country and to provide recommendations for new sites to be designated, all as part of protecting the core of the NEN. Given its iconic status, the Brown bear has been chosen as a flagship species to promote and further develop the network of ecological corridors for the large carnivores in Macedonia, as well as providing a platform for more efficient work towards biodiversity protection in general.

This document therefore compiles all reliable data on the status, ecology and biology of the Brown bear in Macedonia in order to allow identification of the gaps in the current knowledge about the Brown bear population and identification of the appropriate conservation measures for the species in the future.

Резиме

Кафеавата мечка (*Ursus arctos* L.) е најголемото диво животно присутно во Република Македонија. За разлика од останатите крупни диви животни, таа е мошне прифатена и популарна помеѓу луѓето, за што сведочат и резултатите од истражувањата на човековиот став спрема крупните сверови. Тоа е вид со бројни побарувања во поглед на стаништето, вклучувајќи потреба од јадрови подрачја кои се поврзани меѓусебно со еколошки коридори, идеално сместени во рамките на традиционално искористуваните предели каде доминираат пасиштата и тревопасните животни. Врз основа на ова може да се заклучи дека присуството на витална популација на кафеава мечка може да биде добар индикатор за општата состојбата на екосистемот и достапноста на условите од кои имаат корист крупните сверови, како волкот, рисот, и многу други животни и растенија.

Во изминатите две декади, Македонското еколошко друштво (МЕД), во соработка со неколку меѓународни организации од регионот и пошироко, спроведе неколку програми и проекти поврзани со утврдување на статусот и заштитата на кафеавата мечка во Република Македонија. Овие проекти и програми резултираа со собирање на поверодостојни податоци за сегашниот статус на популацијата на кафеавата мечка, кои во иднина ќе овозможат изработка на поволна основа за ефикасна заштита и управување со популацијата на кафеавата мечка во Република Македонија.

Кафеавата мечка којашто се среќава во Република Македонија припаѓа на номиналниот подвид, исто како и целокупната популација на кафеава мечка во Европа. Во минатото присутна низ целата држава, населувајќи ги низинските шуми, рамници и природни ливади, денес кафеавата мечка се среќава само во шумските области на планините од западниот, централниот и јужниот дел на државата. Ограниченото распространување и намалувањето на популацијата се резултат на интензивен лов, уништување и фрагментирање на стаништата на кафеавата мечка, како и на други вознемирувања од страна на луѓето. Проценките на големината на популацијата на

кафеавата мечка се несигурни, базирани на експертско мислење и варираат помеѓу 160-200 единки.

Во 2008 година, МЕД во соработка со Европскиот центар за заштита на природата (ECNC) започна долгорочен проект со наслов “Развој на националната еколошка мрежа во Република”. Проектот има за цел да го отпочне развојот на националната еколошка мрежа (НЕН) во Македонија, како дел од Паневропската еколошка мрежа, преку истакнување и консолидација на постоечките заштитени подрачја во државата и давање препораки за идни заштитени подрачја, а сите тие како составен дел на Националната еколошка мрежа. Кафеавата мечка беше одбрана како репрезентативен вид во две својства: и како закрилен вид (за утврдување на еколошките коридори), и како знаменит вид (за промовирање и унапредување на мрежата од еколошки коридори за крупните сверови во Република Македонија), како и за обезбедување платформа за поефикасна заштита на биолошката разновидност генерално.

Оваа публикација ги содржи сите веродостојни податоци познати до сега за статусот, екологијата и биологијата на кафеавата мечка во Република Македонија, коишто ќе придонесат да се одредат сегашните недостатоци во научните сознанија за кафеавата мечка и соодветните мерки за заштита на видот во иднина.

Përmbledhje

Ariu i murrme (*Ursus arctos* L.) është kafsha më e madhe grabitqare e pranishme në Republikën e Maqedonisë. Për dallim prej kafshëve tjera grabitqare, ai është shumë i njohur në mesin e njerëzve, për çka flasin edhe rezultatet e hulumtimeve të qëndrimit të opinionit publik ndaj bishave të mëdha. Paraqet lloj me kërkesa të ndryshme në aspekt të habitatit, duke përfshirë nevojën për zona qendror të cilat janë të lidhura ndërmjet veti me korridore ekologjike, të vendosura në mënyrë ideale në kuadër të pjesëve tradicionale të shfrytëzuara ku dominojnë livadhet dhe kafshët që kullosin. Në bazë të kësaj mund të konkludohet se prania e popullatës vitale të ariut të murrme mund të jetë indikator i mirë për gjendjen e përgjithshme të ekosistemit dhe qasjen e kushteve prej të cilave kanë dobi bishat e mëdha, si ujku dhe rrëqebulli, dhe shumë kafshë dhe bimë tjera dhe habitatet në të cilat ata mund të prosperojnë.

Në dy dekadat e fundit, Shoqata ekologjike maqedonase (ShEM), në bashkëpunim me organizata tjera ndërkombëtare nga rajoni dhe më gjerë, realizoi disa programe dhe projekte lidhur me statusin dhe mbrojtjen e ariut të murrme në Republikën e Maqedonisë. Këta projekte dhe programe rezultuan me mbledhjen e të dhënave më të besueshme për statusin aktual të popullatës së ariut të murrme, të cilat në të ardhmen do të mundësojnë përpunimin e bazës së volitshme për mbrojtjen efektive dhe menaxhimin me popullatën e ariut të murrme në Republikën e Maqedonisë.

Ariu i murrme i cili haset në Republikën e Maqedonisë i takon nënlllojit nominal, njësoj si edhe popullata e tërësishme e ariut të murrme në Evropë. Në të kaluarën ka qenë e pranishme nëpër mbarë shtetin, duke i populluar malet e ulëta rrafshinat dhe livadhet natyrore, sot ariu i murrme haset në rajonet pyjore të maleve të pjesës perëndimore, qendrore dhe jugore të shtetit. Përhapja e kufizuar, si dhe ulja e numrit janë rezultat i gjuajtjes intensive, shkatërrimit dhe fragmentimit të habitateve të ariut të murrme, si dhe shqetësime tjera nga ana e njerëzve. Vlerësimi numrit të popullatës nuk dihen me siguri, i bazuar në mendimin e ekspertëve lëviz rreth 160-200 arinj të murrme.

Në vitin 2008, Shoqata Ekologjike Maqedonase në bashkëpunim me Qendrën europiane për mbrojtjen e natyrës (ECNC) filloi projekt afatgjatë me titull “Zhvillim i rrjetit nacional ekologjik në Republikë”. Projekti ka për qëllim ta përparojë zhvillimin e Rrjetit ekologjik nacional (NEN) në Maqedoni, si pjesë e Rrjetit ekologjik paneuropian. Ariu i murrme u zgjodh si lloj kryesor për promovimin dhe përparimin e rrjetit të korridoreve ekologjike për bishat e mëdha në Republikën e Maqedonisë, si dhe për mbrojtjen më efikase të biodiversitetit në përgjithësi.

Dokumenti i përmban të gjitha të dhënat e besueshme për statusin, ekologjinë dhe biologjinë e ariut të murrme në Republikën e Maqedonisë, të cilët do të kontribuojnë të përcaktohen mangësitë e deritanishme në njohuritë shkencore të ariut të murrme dhe masat përkatëse për mbrojtjen e këtij lloji në të ardhmen.

1. INTRODUCTION

The Brown bear (*Ursus arctos* L.) is a large carnivore distributed across much of northern Eurasia and North America. Once present all over Europe, today bears are extinct in most of the western European countries. In the Balkans the Brown bear population is spread mostly along the Dinaric Alps mountain range. The major causes of the drastic decline of bear populations and habitats, especially during the last century, are intensive hunting, destruction and fragmentation of the bear's habitat due to human activities, and lack of information and sensitization of the wider public (Arcturos, 1997).

Taking into account the stable population on the Dinaric Alps mountain range, the Balkan countries play a significant role in the distribution and conservation of the Brown bear in Europe.

Several projects and programmes focusing on Brown bear conservation have been implemented in Macedonia during the last 15 years. The Macedonian Ecological Society (MES) has been involved in several such projects, mostly in cooperation with other organizations from the Balkans. Starting in 1996, MES in cooperation with Greek NGO Arcturos carried out two projects aiming to establish a network for awareness raising and the conservation of wildlife and nature in Balkan countries that are host to bear populations. The "Balkan Lynx Recovery Programme" is another project run by MES dealing with long-term conservation of the Balkan lynx, its prey and other species under its umbrella. Besides the focus on the Balkan lynx, this project also aimed to gain knowledge on the other two large carnivores living in Macedonia (Brown bear and wolf), raise awareness among the local people, establish new protected areas in the region and build a network of people involved in nature protection.

In 2008, MES in cooperation with ECNC-European Centre for Nature Conservation began a long-term project called "Development of the National Ecological Network in the Republic of Macedonia". The main goal of this project is to boost the development of the Macedonian National Ecological Network as part of the Pan-European Ecological

Network. Since the Brown bear is taken as a flagship species in this project, development of a management plan for an ecological corridor for large carnivores, with special focus on the Brown bear, is one of the activities foreseen.

All of these activities undertaken in Macedonia will lead to better and more efficient work towards biodiversity protection in general.

With its charisma and good reputation (Lescureux and Linnell 2010., in press), the bear can serve as both an umbrella and a flagship species. The main goal of the MAK-NEN project is to define the ecological corridors in Macedonia. For this purpose, and bearing in mind its territorial behaviour, dependence on the good quality of habitats and food abundance, the Brown bear is an excellent indicator for disturbances of the environment and a guide for the ecological corridors which are worth preserving and protecting.

This document focuses on compiling data from the literature, statistical documents from the hunting archive, as well as ground-based knowledge obtained from the ongoing Balkan lynx project. Data on Brown bear taxonomy, diet, life cycle and habitat preferences are given in this report. This document can serve as a basis for the further investigation of this species, both regarding its biology (ecology) and for the conservation measures to be undertaken in the future.

2. BIOLOGY AND ECOLOGY

2.1. Taxonomy and phylogeny

The Brown bear living in the Balkan Peninsula (consequently in Macedonia) belongs to the nominal subspecies *Ursus arctos arctos*, the same as the whole European Brown bear population (Ruskov and Markov, 1974). Brown bears in southern Europe are relics from the late Pleistocene, in phylogenetic relationship with the subspecies *Ursus arctos syriacus* from Asia Minor. Recent morphological studies showed that the bears from the Balkans differ from the Russian-Carpathian populations and are close to the other Mediterranean populations (Spasov, 1997). The genetic survey on the European Brown bear indicates that the southern European Brown bear populations, including the Balkan lineage, are very close to one another and differ significantly from the populations in central, northern and eastern Europe (Taberlet and Bouvet, 1994).

2.2. Description

The Brown bear is the largest carnivore on the European continent. The adult females weigh on average 100 kg, while the average weight of the males is 150 kg. However, sometimes individuals can grow to over 300 kg. During the year, the weight of adult individuals can vary: they are the heaviest in late autumn before hibernation and weigh least at the beginning of summer, after the rutting season. Brown bears have furry coats in shades of brown, blonde, black, or a combination of these colours. According to some unverified observations, the Balkan bear shows remarkable polymorphism regarding its coloration, having a high percentage of rather light (golden) specimens (Spasov, 1990).

The Brown bear is a plantigrade, as are humans, and can stand up on its hind legs for extended periods of time. Brown bears have a large hump of muscle over their shoulder which distinguishes them from other bear species. The forelegs end in massive paws with strong claws 5-6 cm in length which are mainly used for digging. The claws are not retractable as in cat species, and have relatively blunt points.



Figure 1: Brown bear photographed in Mavrovo National Park. Photo by: BLRP



Figure 2: Brown bear paw-prints. Photo by: MES

Bears are solitary and elusive animals. Males and females meet only during the mating period. The family group, composed always of female and cubs, forms a strong nucleus that usually splits after two years. They have a predominantly nocturnal activity pattern which is a result of hunting and the high disturbance potential in the multi-use landscapes (Swenson et al., 1996; Swenson, 1999). There is a difference between the activity pattern of yearling and adult bears, with subadults being somewhat in between (Kaczensky et al., 2005). Adults are mainly nocturnal, whereas the yearling can be found active at any time.

2.3. Diet

The Brown bear is an omnivore species that adapts its diet according to food availability and human activities in its habitat. As a result of regional differences in the quality and availability of foods, Brown bears have a broad diet range between regions (Krechmar, 1995; Jacoby et al., 1999). For instance, in the central part of Sweden Brown bears obtain 44-46% and 14-30% of their total annual energy from berries and ungulates, respectively, and the rest from insects (14-22%, mostly ants) and forbs and graminoids (12-18%) (Dahle et al., 1998). In the central part of Norway they obtain 65-87% from ungulates (mainly sheep), 6-17% from berries and the rest from ants, forbs and graminoids (Dahle et al., 1998). In Croatia bears derive up to 95% of their dietary food energy from plants (Cicnjak, 1991). In Greece the bear's annual diet is dominated by food items of plant origin (87%), followed by animal material (13%), mostly insects (Mertzanis, 1994).

Although there is a lack of data on the feeding ecology of bears in Macedonia, we assume that they have the same food habits as those in Greece, as the Brown bear populations from the Balkan lineage are very close to one another (Taberlet and Bouvet, 1994), and bear populations in Macedonia and Albania constitute the connecting populations between the Brown bear populations of Serbia, Kosovo, Montenegro, Bosnia and Herzegovina, Croatia and Slovenia in the north and the endangered Brown bear population of Greece, where the species reaches its southernmost European distribution (Mertzanis, 1999). The Brown bear's food varies seasonally. Main food in spring consists of some remains of acorns and herbaceous plants. During summer the major part of food consists of soft fruits (fruits from *Pyrus* sp., *Malus* sp., *Prunus* sp., *Vaccinium* sp., etc.), with a maximum in autumn. Besides the fruits, hard masts, mainly acorns and beech masts are also essential food for bears in

autumn. Animal material consists primarily of ants (maximum consumption in summer), whereas the percentage of other mammal prey (dominance of domestic ungulates, especially cattle, with the highest number of attacks concentrated in autumn) is considerably low – 2% of the total diet (Mertzanis, 1994).

2.4. Life cycle

Brown bears have relatively low reproductive rates, with females giving birth at most every second year. Bears mate from the end of May until mid-June. The males travel great distances during this period, and fight among themselves when they come close to the same female. The embryo in the uterus has delayed implantation, with the greater part of its development occurring during the last three months of the gestation, which is seven months long. Cubs are born from January to March in the following year. A bear spends the winter in a specifically selected and prepared den, usually located in small hollows in rocks, which bears adapt to their needs by digging. The female usually gives birth to 1-4 cubs weighing approximately 350 g. They are born blind and hairless.

The survival of the cubs is influenced by several factors, grouped as nutritional (food availability, condition of the mother), social (mainly intraspecific predation) and disturbance factors (mainly by humans). Several studies have shown that the factor that most influences cub survival is infanticide (Bunnell and Tait, 1985; Swenson, 2001). The survival of the cubs has been found to vary within an area (Swenson et al., 1997) and spatially among areas (McLellan, 1994; Swenson et al., 1997). The estimated mortality rate of bear cubs in Sweden was 0.35 (n=126) in the south and 0.04 (n=78) in the north (Swenson, 2001). The cubs stay with the mother their entire first year of life and separate from her at the age of one and a half years, when the next mating takes place. Brown bears reach sexual maturity at the age of 3-4 years, and can survive in nature until the age of 10-20 years.

2.5. Habitat and range size

For its biological needs the Brown bear has distinct requirements for different habitat characteristics. The Brown bear used to live in lowland forests, flood plains and natural meadows. As the human population spread, bears were pushed into areas less suitable for humans. Thus, at

present they can be found in mountainous forested areas. The crucial habitats for the Brown bear are the old broadleaf forests (oak and beech forests) and mixed forests with openings and reach undergrowth of fruit bushes. Occasionally, bears can be found above the upper limit of the forest belt, attracted by the livestock and the blueberries.



Figure 3: Typical Brown bear habitat. Photo by: MES

The average daily movement of a bear is 1.6 km, while the maximum is over 10 km. There are seasonal differences in Brown bear movement and activity. Bears show increased activity during the mating period (from May to mid-June) when the males and females roam to mate, and in autumn, when bears look for mature forests with large quantities of food, such as beech nuts and acorns. In winter their activity decreases as they retreat to inaccessible, quiet areas to den and for females also to give birth.

The individual territory of Brown bears varies. For instance, in northern parts of Sweden, the size of an adult female home range varied between 171-1,024 km², while the size of an adult male home range was considerably bigger and varied between 236-2,364 km² (Bjarvall et al. 1990). In Croatia by using radio telemetry the individual territory was estimated to be between 6,000 and 22,400 ha (Huber and Roth, 1993). In Greece, using the same method, up to 31,000 ha was estimated as individual territory for a female with cubs (Mertzanis et al., 2004). The size of a home range depends on many factors, such as: sex, age, body

size, food availability and population density (Dahle and Swenson, 2003; Dahle et al., 2006). Home-range sizes are larger for males than for females, and home-range size increases with increasing body size, but is not related to individual age. Home-range size is decreasing with the increase of the population density. Males and oestrous females use large ranges in the mating season, but decrease their ranges after the mating season, because both sexes of this species roam to mate. Females with cubs restrict their range size during the mating season in order to avoid contact with infanticidal males and increase their ranges in the post-mating season. There are no significant differences between spring, summer and autumn range sizes; average winter range is significantly smaller than other seasonal ranges.

2.6. Distribution and population size in the Republic of Macedonia

The Brown bear population in Macedonia is part of the Alps–Dinaric–Pindos population living in the forested areas extending from the eastern Alps in Austria and north-eastern Italy in the north to the Pindos Mountains in Greece in the south. The total population size is estimated to be 2,800 individuals. Because the forested areas in the Balkan countries are less connected compared with the Carpathian ones, the population may be divided into several subpopulations (Sørensen, 1990) or may become distinct populations if these corridors become unusable due to human activities (Zedrosser et al., 2001).

The Brown bear range in Macedonia is mainly in the mountainous areas along the border with Kosovo, Albania and Greece. There is evidence for Brown bear presence on Jakupica and Nidze Mts, and occasionally some bears enter from Bulgaria on the eastern mountains, mainly Maleshevski Planini (Stojanovski and Arsovska, 1996). The population estimations are uncertain. According to Zedrosser et al. (2001), there are fewer than 200 Brown bears in Macedonia. Melovski and Godes (2002) estimated that the population size is 160-200, which may be realistic numbers, bearing in mind the size of the habitat in the bear range in Macedonia and the existing national parks.

3. RECENT ACTIVITIES REGARDING THE MONITORING AND CONSERVATION OF THE BROWN BEAR POPULATION IN THE REPUBLIC OF MACEDONIA

The Brown bear, as the largest carnivore species in Macedonia, has not yet been studied completely. The literature data concerning the species in Macedonia are very poor, mainly dealing with taxonomy or representing individual data in some regional faunistic investigations (Karaman, 1930; Martino, 1936, 1937, 1939; Dimovski, 1968; Petrov and Garevski, 1983). The first systematic investigations on the Brown bear population in Macedonia were conducted by the Macedonian Ecological Society during the realization of several projects in cooperation with Arcturos in the period 1995-1999 and the "Balkan Lynx Recovery Programme" in the period 2006-2009. The activities and results of these projects are detailed below.

3.1. ARCTOS project

The ARCTOS project was implemented by the Greek NGO Arcturos in two phases (first phase 1994-95, second phase 1997-99). In order to conserve the natural areas which act as linkage areas between bear populations in the Balkans, the project has achieved cross-border cooperation with the neighbouring countries (Albania, Serbia, Bulgaria and Macedonia). Project ARCTOS supported the Balkan NET for conservation of the bear and other large carnivores by organizing meetings, seminars, transborder scientific research and implementing other common conservation actions.

3.2. TEDDY project

The TEDDY project (1996-97) was a joint transboundary project initiated by the Greek-based NGO Arcturos, with input from NGOs in neighbouring countries. The overall aim of the project was to create a network for awareness raising and the conservation of wildlife and nature in European countries that are host to bear populations.

The method applied in this project was a questionnaire survey among local inhabitants living in the “bear area” (western Macedonia). The questionnaire was disseminated by representatives of MES, Bird Study and Protection Society of Macedonia and students from the Faculty of Natural Sciences and Mathematics (Institute of Biology), during the period September 1996 to February 1997. Another component of the project was raising awareness among the local people about the Brown bear, carried out by a group of journalists from the NGOs “Journalists’ Environmental Center” – ERINA. Under this project, a number of posters and leaflets were produced and distributed, mainly in areas hosting bear populations, and numerous articles were published in many newspapers and magazines. The themes concerned the conservation of the Brown bear, the dancing bear problem, legislation and hunting, and field guides for signs of and damage caused by Brown bears.

This project was the first step towards the better study and protection of the Brown bear in this region. The results of the project are compiled in the Compendium on the Status of the Brown bear in the South Balkans.

3.3. BALKAN NET project

The BALKAN NET project (1997-98) aimed to continue and extend the activities of an established network between the Balkan countries for awareness raising and sustainable nature conservation in areas hosting Brown bear populations and to include Macedonia in its actions. The Network concerns organizations dealing directly or indirectly with the natural environment (non-governmental organizations, organizations of local authorities as well as public services). The main goal of the project was the preservation of the Brown bear population and its habitat in the Balkan area.

3.4. Balkan Lynx Recovery Programme (2006-2009)

In 2006, the Macedonian Ecological Society started the project “Balkan Lynx Recovery Programme”, which aims to secure the survival of the remaining Balkan lynx population through the establishment of a series of protected areas as well as through improved wildlife management within and outside future transboundary protected areas where strongholds of the Balkan lynx exist. One of the project tasks was to conduct a lynx

baseline survey to assess the distribution and the relative abundance of lynx and its potential prey species, as well as for the Brown bear and wolf by conducting questionnaires in possible lynx distribution areas. The questionnaires contained 50 questions related to the presence and distribution of large carnivores and ungulates, depredation on livestock, livestock breeding and socio-economic aspects of villages over the last 5 years. The questionnaire survey was carried out among people of different profiles, the following profiles/occupations being taken as the most representative: hunters, game wardens, foresters, shepherds, livestock breeders, beekeepers, cafeteria or shop owners and at least two randomly selected people.

4. STATUS OF THE BROWN BEAR POPULATION IN THE REPUBLIC OF MACEDONIA

Karaman in 1930 for the first time presented data on the status of the Brown bear population for the area of Jakupica Mt. and Skopska Crna Gora Mt. The data showed that the Brown bear had been exterminated from the areas due to overhunting; occasionally some individuals could be found during their migration from Shar Planina Mt. Later on Dimovski (1968) confirmed the presence of Brown bear on these mountains. Thus, it seems that there was a recovery of the Brown bear population in these areas.

The first systematic data on the status of the Brown bear in Macedonia were collected by the questionnaire survey in the framework of the TEDDY project during 1996-97. The following regions were visited: NP Pelister, NP Galichica, Korab Mt., Jablanica Mt. and some parts of Plakenska, Deshat and Karaorman Mts (Figure 4). A total of 74 villages were visited and 132 questionnaires were filled in. People for the interview were chosen at random. Most of those questioned were of the opinion that the Brown bear population has been stable over the last decade. Exceptions to this were noticed in the western parts of Galichica Mt. (decreasing population), eastern parts of Galichica Mt. (small increase of the population has been noticed lately) and Jablanica Mt. (increasing). There was direct information about Brown bear presence throughout the whole study area, except for the southernmost part of Karaorman Mt. (north of Ohrid Lake) where Brown bears have not been seen for many decades (Arsovska, 1997).

According to the questionnaire survey, the Brown bear is mainly distributed in the mountainous western parts of the country; it occupies the slopes of Shar Planina, Korab, Bistra, Stogovo, Karaorman, Jablanica, Ilinska - Plakenska Mts, Galichica and Baba Mts (Figure 5). There is also evidence of bear presence on Jakupica and Nidze Mts. A small number of individuals could be entering from Bulgaria in the east, on Maleshevo Mt. Taking into account the size of the habitat and the existence of three

national parks, it was assumed that about 160-200 bears live in Macedonia. To change from an estimate to more realistic figures for the Brown bear population in Macedonia, a lot of systematic fieldwork has to be done, especially working with a genetic sampling approach.

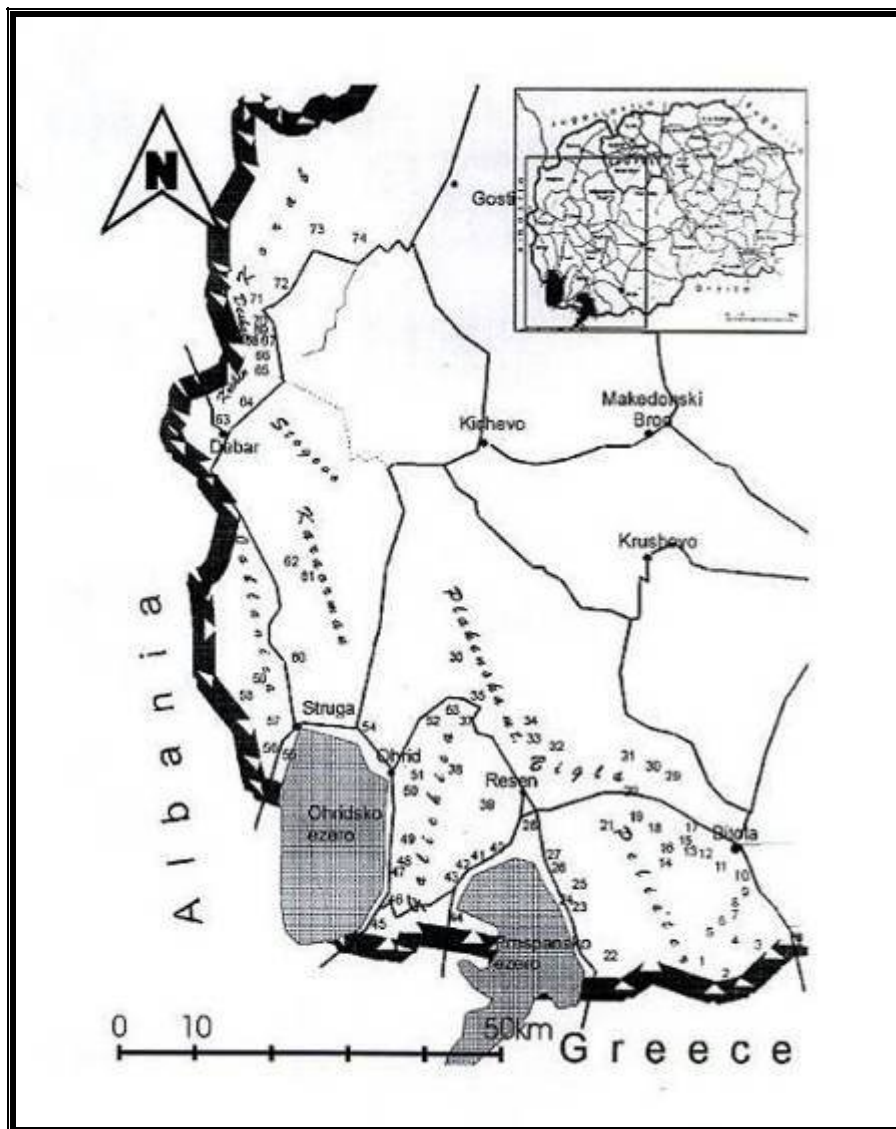


Figure 4: Map of area investigated during the questionnaire survey in 1996-97.



Figure 5: Map of Brown bear distribution in the Republic of Macedonia (according to Arcturos, 1997).

Kryštufek and Petkovski in 2003 gave data on the distribution and population trend of the Brown bear in Macedonia. According to them, the Brown bear can be found only in the mountain area in western Macedonia and the population is in decline. Recent data on the status of the Brown bear in Macedonia were collected during the Lynx Baseline Survey (2006-2009). In total, 553 interviews were done in 153 villages in western, central and south parts of Macedonia. Additionally, the questionnaire survey was conducted in eastern and central parts of Macedonia (150 interviews in 44 villages) in the framework of the projects "Osogovo in the Balkan Green Belt" and "Development of the National Ecological Network in the Republic of Macedonia (MAK-NEN)". In this way, almost all the territory of the country was covered. All data were entered and analysed using SQL database. For better presentation of the data, the study area was divided into 15 regions (Figure 6): Shar Planina Mt., Jakupica Massif, Suva Gora-Cheloica Mts, Mavrovo-Bistra (the National Park and the remaining part of Bistra Mt.), Stogovo-Karaorman Mts, Ilinska-Plakenska Mts, Jablanica Mt., Galichca Mt. (National Park and Istok Mt.), Pelister Massif (National Park and the remaining part of Baba Mt.), Nidze-Kozhuf Mts, Babuna and Dren Mts, Belasica Mt., Maleshevo region (Maleshevski Mts, Ograzden Mt. and Plackovica Mt.), Osogovo Mts, and German region (Bilina Mt., German Mt. and Chupino Brdo).

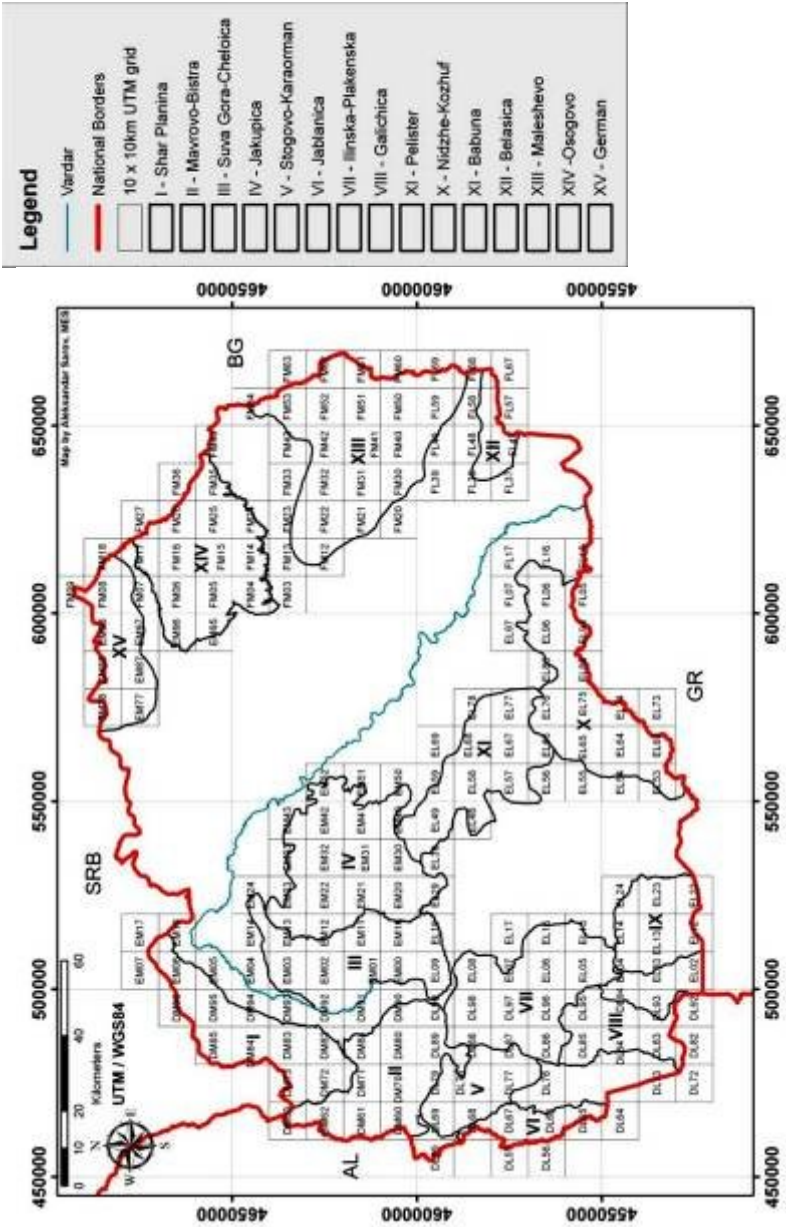
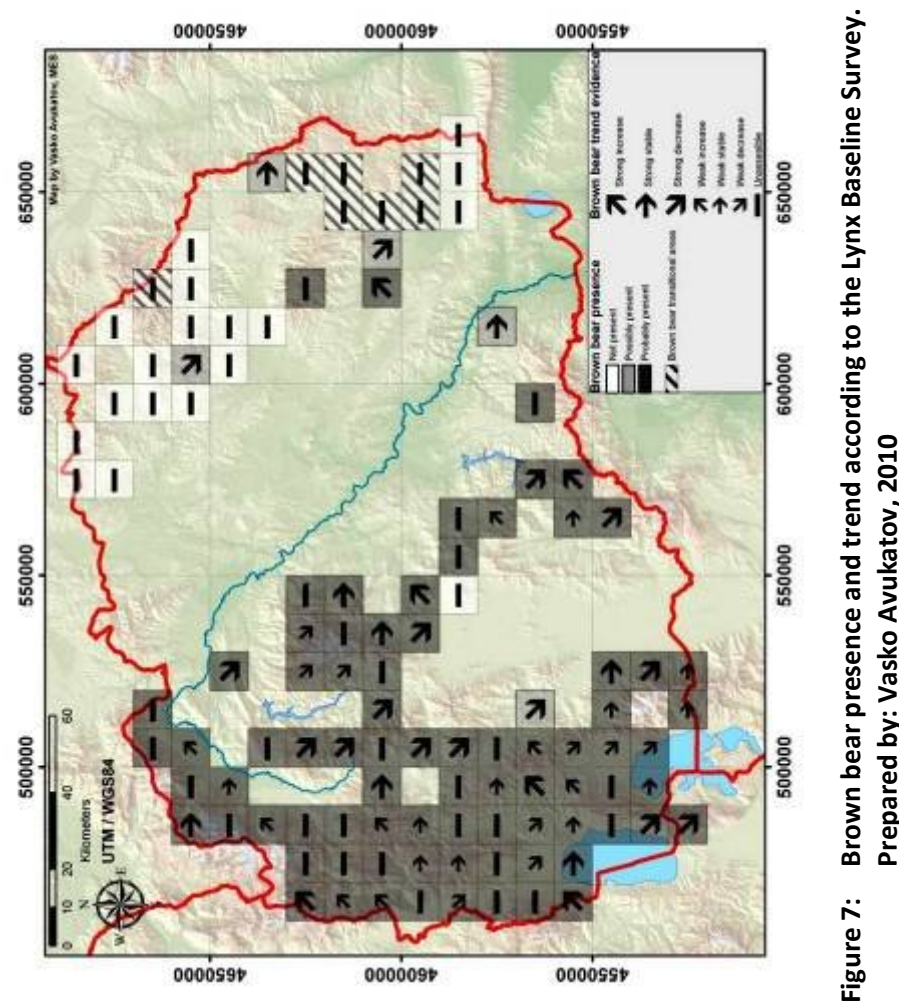


Figure 6: The study area divided into regions designed for the Lynx Baseline Survey (I-X) and for other species (VI-VV) Document by: Aleksandar Stankov 2010

The presence of each species was assessed according to the number of positive responses per grid cell. More than 50% positive responses indicates probable presence, less than 50% indicates possible presence and no positive responses indicates that the species is not present. The population trend was assessed by asking the interviewees for their

personal judgement of the population dynamics during the last 5 years per grid cell. In cases where more than 75% of interviewees answered that the population is increasing, decreasing or stable, there is strong evidence for the population trend. There is weak evidence when 50–75% of interviewees had the same judgement for the trend, while in all other cases the trend was not assessable. This methodology was designed and applied by experts on large carnivores in the framework of the BLRP project (Melovski et al., 2008) and partly in the MAK-NEN project.



The results from this investigation (Figure 7) showed that the Brown bear is present all over the study area in western, central and southern parts of Macedonia. In the eastern part there is only temporary occurrence of Brown bears with some individuals migrating from Bulgaria, mainly on

Maleshevski Planini Mt. and Plachkovica Mt. A cause for concern is that most of the grid cells with a declining trend are outside recent protected areas (NPs).

Besides presence and population trend, data on relative abundance of the Brown bear in the study area were also collected. These data were grouped into 5 categories of answers for each region: very common, common, rare, not present and don't know (when interviewee does not have information).

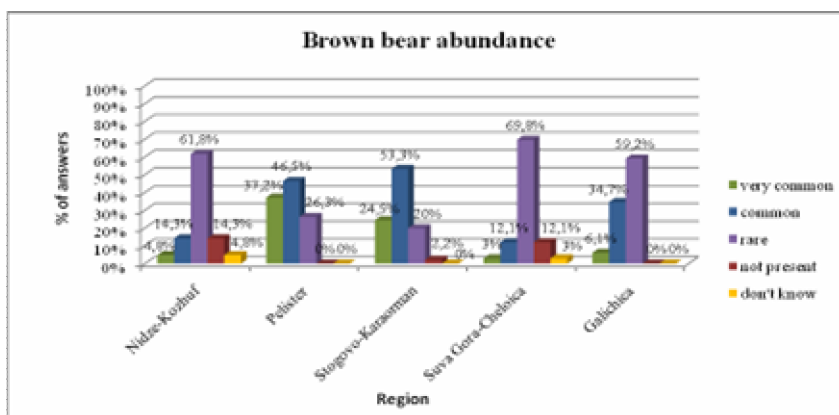


Figure 8: Brown bear abundance in Nidze-Kozhuf, Pelister, Stogovo-Karaorman, Suva Gora-Cheloica and Galichica regions according to the answers to the interviews.

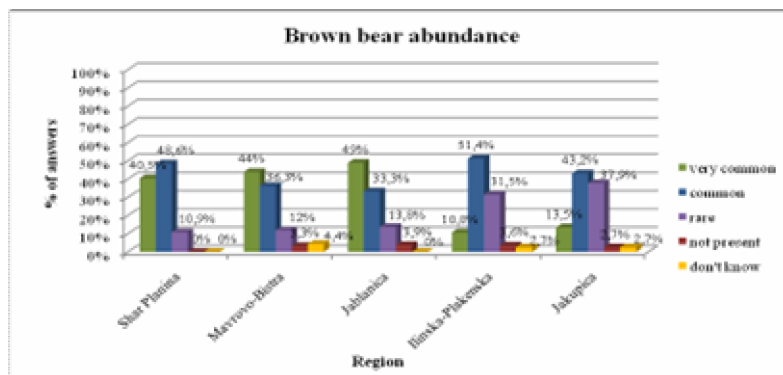


Figure 9: Brown bear abundance in Shar Planina, Mavrovo-Bистра, Jablanica, Ilinska-Plakenska and Jakupica regions according to the answers to the interviews.

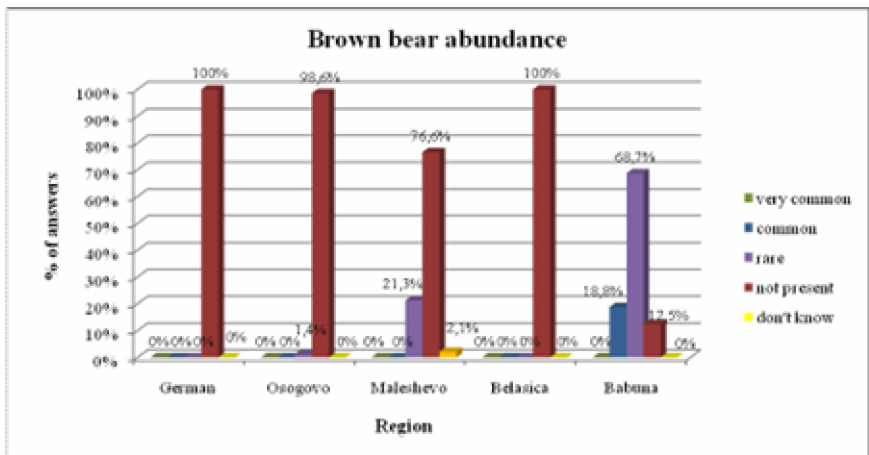


Figure 10: Brown bear abundance in German, Osogovo, Maleshevo, Belasica and Babuna regions according to the answers to the interviews.

The Brown bear is very common or common in the Shar Planina, Mavrovo-Bистра, Jablanica, Jakupica, Ilinska-Plakenska, Stogovo-Karaorman and Pelister regions, while it is rarely found in the Babuna, Nidze-Kozhuf, Suva Gora-Cheloica and Galichica regions. Most of the interviewees from the north-eastern and eastern part of the country claimed that the Brown bear is not present and has not been seen for decades (Figures 8 to 10).

It must be stressed that the data and results presented above represent local people's knowledge and opinions. These data are category III according to SCALP¹ criteria (Molinari-Jobin et al., 2003), which means that they are scientifically unconfirmed data.

¹ SCALP criteria were developed by a group of international lynx experts in the framework of the initiative "Status and Conservation of the Alpine Lynx population" (SCALP). There are 3 categories of data according to the possibility of verifying the data:

- Category I - hard facts
- Category II - confirmed observations
- Category III - unconfirmed observations

Figure 11 shows the present distribution of the Brown bear population in the Republic of Macedonia according to all hard evidence (dead bear, scat, pawprint, hair, cam-trap photo and sighting) collected during the ground investigation, as well as all positive answers concerning bear presence from the interviews. As expected, most of the evidence and positive answers are from the mountains in western, south-western and southern parts of Macedonia (Shar Planina, Korab, Bistra, Deshat, Stogovo, Karaorman, Jablanica, Galichica, Pelister, Nidze, Bigla, Ilinska and Plakenska Mts).

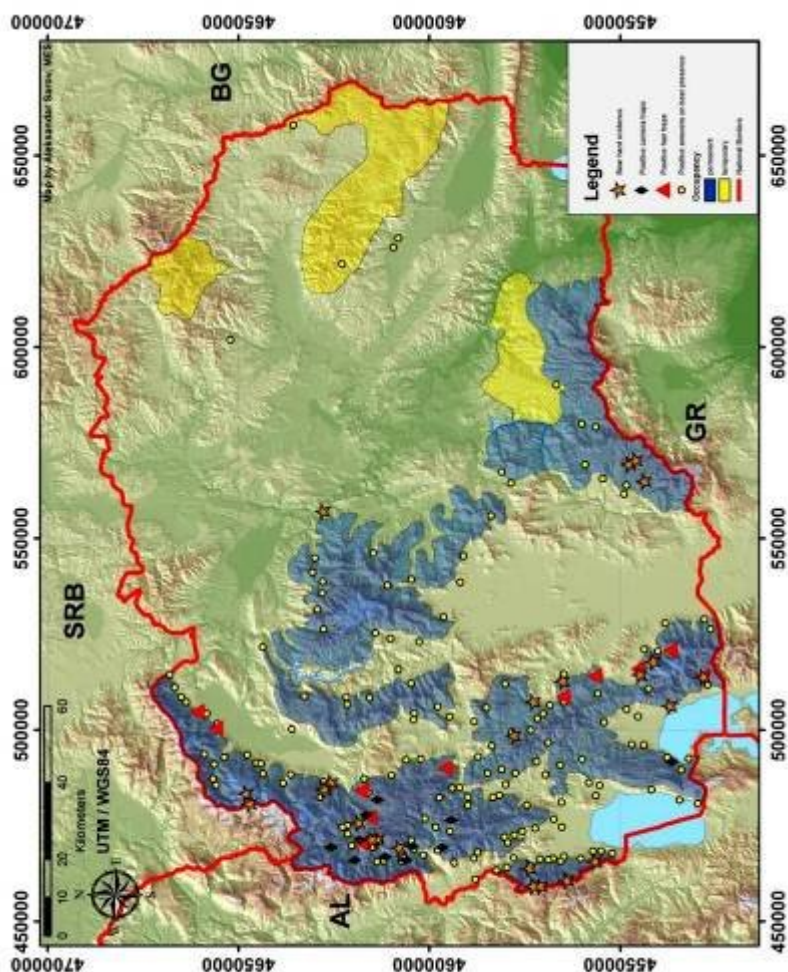


Figure 11: Brown bear presence in the Republic of Macedonia according to all positive ground data. Prepared by: Aleksandar Sarov, 2010

There is no hard evidence from the areas of Jakupica, Suva Gora and Babuna, but still these areas are constantly occupied by Brown bear, which was proved by many positive answers from the interviews. The situation in the north-eastern, eastern and south-eastern parts of the country is completely different. In most of the areas the Brown bear is not present at all, except for the region of Maleshevski Planini, Plachkovica and Osogovo, where the Brown bear occurs temporarily as a result of the migration of some individuals from the Bulgarian population.

5. HUMAN ATTITUDES TOWARDS BROWN BEAR

The results of the questionnaire survey conducted during 1996-97 proved that the great majority of the people questioned have a very positive opinion about the Brown bear, with very few exceptions when people considered the Brown bear to be a dangerous and harmful animal (Arsovska, 1997).

Apart from the Lynx Baseline Survey, MES conducted another questionnaire survey in the period 2007-08 (BLRP). The aim of this survey was to assess the attitude of humans towards the large carnivores and possible human–large carnivore conflicts. This survey was conducted in the areas where the three large carnivores – Brown bear, wolf and lynx – are most probably present.

Basically, the methodology of the two investigations is the same (face-to-face interviews), but there are also differences in the design of the questionnaire, the approach itself and the method of analysis and interpretation of results. However, the general conclusions of both are the same: most people like the bear and do not consider it a threat.

In total there were 362 respondents to the questionnaire. 85% of the respondents were male; 16.3% of respondents, all of whom were male, reported that they were active hunters.

Table 1: People's opinion about the Brown bear in Macedonia.

	Frequency	Per cent
Completely against	11	3.0
Against	30	8.3
Neutral	72	19.9
In favour	196	54.1
Completely in favour	52	14.4
No data	1	0.3
Total	362	100.0

The results presented above (Table 1) show that most of the people interviewed (68.5%) have a positive attitude towards the Brown bear and are in favour of it.

Table 2: Answers to the statement: It is not necessary to have Brown bear in Macedonia.

	Frequency	Per cent
Strongly disagree	89	24.6
Disagree	185	51.1
Neutral	28	7.7
Agree	46	12.7
Strongly agree	12	3.3
No data	2	0.6
Total	362	100.0

The majority of the people interviewed (75.7%) strongly disagree or disagree with the statement that it is unnecessary to have Brown bear in Macedonia (Table 2) and are in favour of having it as a natural value for future generations (87.5 %, Table 3).

Table 3: Answers to the statement: It is important to maintain the Brown bear population in Macedonia.

	Frequency	Per cent
Strongly disagree	3	0.8
Disagree	21	5.8
Neutral	21	5.8
Agree	260	71.8
Strongly agree	57	15.7
Total	362	100.0

Almost half of the people questioned (48.3%) answered that the Brown bear does not frequently damage livestock, but a significant percentage (38.9%) stated that the bear causes depredation damage (Table 4).

Table 4: Answers to the statement: The Brown bear frequently damages livestock.

	Frequency	Per cent
Strongly disagree	16	4.4
Disagree	159	43.9
Neutral	45	12.4
Agree	125	34.5
Strongly agree	15	4.1
No data	2	0.6
Total	362	100.0

However, most of them disagree that the bear causing damage should be killed immediately (57.5%, Table 5), but a considerable proportion (32.8%) thinks that they should be pursued. This result is probably due to the fact that people usually do not take the necessary damage prevention measures (against depredating animals) and the fact that damage from bears is minimal, with few exceptions; in addition, the damage compensation system in Macedonia functions slowly.

Table 5: Answers to the statement: Damage-causing Brown bear should be killed.

	Frequency	Per cent
Strongly disagree	31	8.6
Disagree	177	48.9
Neutral	34	9.4
Agree	99	27.3
Strongly agree	20	5.5
No data	1	0.3
Total	362	100.0

A surprisingly large percentage (82.3%) of people think that the Brown bear should be protected by law in Macedonia (Table 6) and hunting it should be permanently forbidden.

Table 6: Answers to the statement: The Brown bear should be protected by law in Macedonia.

	Frequency	Per cent
Strongly disagree	9	2.5
Disagree	25	6.9
Neutral	29	8.0
Agree	188	51.9
Strongly agree	110	30.4
No data	1	0.3
Total	362	100.0

Concerning “fear” of the bear as an important issue in this investigation, most of the people interviewed (67.7%) said that they have not heard of Brown bear attacking or killing people (Table 7), but 47% are still frightened by its appearance (Table 8).

Table 7: Answers to the statement: Brown bear attack and kill people.

	Frequency	Per cent
Strongly disagree	60	16.6
Disagree	185	51.1
Neutral	37	10.2
Agree	63	17.4
Strongly agree	14	3.9
No data	3	0.8
Total	362	100.0

Assessing people’s fear of and attitude toward the Brown bear is important in relation to the question of “will people accept the bear” and share their surroundings with such a “large” carnivore; one can also anticipate potential human–bear conflicts and obstacles in increasing the bear area in some areas. This investigation can point out the specific group of people who need to be targeted in the future (through educational programmes and campaigns) in order to overcome the reasons for their fear.

Table 8: Answers to the statement: The brown bear is frightening.

	Frequency	Per cent
Strongly disagree	47	13.0
Disagree	129	35.6
Neutral	16	4.4
Agree	131	36.2
Strongly agree	39	10.8
Total	362	100.0

6. LEGISLATION

The Brown bear has been protected by the Law on Hunting since 1996 (Official gazette of RM 20/96). According to Articles 9 and 13 of the new Law on Hunting adopted in 2009, the bear is considered as a protected game species and its hunting is permanently prohibited. Nevertheless, there is an exception. Hunting might be allowed with permission from the Ministry of Agriculture, Forestry and Water Economy (MAFWE) and the Ministry of Environment and Physical Planning (MEPP) for scientific and educational purposes, for zoos and natural history museums, for breeding and the prevention of contagious diseases, as well as when the species is causing damage (Articles 15, 16 par. 5). In cases where the species causes damage, the MAFWE issues a hunting permit in accordance with the advice of the Government's administrative body responsible for nature protection.

Additionally, the Brown bear is listed in several international agreements ratified by the Republic of Macedonia: Appendix II of the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats) as a strictly protected fauna species and Appendix II of CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna).

7. THREATS

Although the Brown bear is legally protected, its existence still depends on human willingness to accept the bear in our environment. The population of Brown bear in Macedonia is exposed to many threats, most of them due to human activities.

7.1. Poaching

So far, the literature data (Melovski and Godes, 2002; Arcturos, 2002; Ivanov et al., 2007; Keçi et al., 2007) and field experience have identified illegal hunting (poaching) as one of the biggest threats to the bear's existence. The proof for this is the actual distribution: the bear is best distributed in the protected areas because there is no poaching, or at least it is not significant. Poachers usually kill bears on a impulse, to show their supremacy in the wilderness and, to be even more absurd, they may leave the shot animal to rot. Some may kill bear in "self-defence" and some for meat or trophy (fur, claws and whole stuffed animal) (Melovski et al., 2008). We believe that there is even a black market where it is relatively easy to pre-order and obtain bear meat or a trophy. Bears are very often caught in foot snares (made from steel rope) set by poachers (Figure 12). These snares are not selective and the trapped animal dies in agony from dehydration or exhaustion, or it is killed by predators or poachers. Just one inspection conducted on site in July 2006 by the authorities (State Environmental Inspectorate, MEPP) in a hunting ground near Debar revealed two cases of bears caught in such snares. One was found dead (decomposed) while the other tore the steel rope and broke loose. The official report from the same inspection says that only that year (until July 2006) around 500 poaching snares were removed from that area. Local police suspected that the poachers setting the traps were from bordering villages in Albania, and that their main intention was to catch wild boar or roe deer in the traps (Report of the State Environmental Inspectorate, 2006).

In cases where the mother is poached, sometimes the cubs are caught and kept in captivity in private cages or given to city zoos, but usually they are left in the wild with little chance of survival.



Figure 12: Brown bear caught in a steel rope snare near the village of Izvor, Bistra Mt. Photo by: Panajot Čorovski

7.2. Habitat fragmentation

Generally, the habitats presently occupied by the bear (mainly in the western and central parts of Macedonia) are in more or less good condition (Arcturos, 2002). This is mainly because of the rural-urban migration and abandonment of the mountain villages. The severe fragmentation of bear habitats and poaching have resulted in almost no presence of bears in eastern Macedonia. With the exception of the national parks, the other protected areas in Macedonia are small and cannot provide suitable habitats for the large carnivores. It is even more of an issue that these areas are not interconnected, but distinct and sometimes the landscape between them is fragmented. Such conditions restrict the bear's movement and do not allow extension of their areal. All state-owned forests in Macedonia are managed by a public enterprise.

The way the forests are managed is not suitable for the large carnivores. For example, the oak forests are clearcut every 35-45 years, not allowing the forest to mature and produce nuts, an important food resource for many species, including bear (Figure 13) (Arcturos, 2002).



Figure 13: Clearcuts in bear habitat (oak forest). Photo by: MES

Poor road infrastructure and traffic density only slightly fragment the bear's habitat and influence its migration. However, the existing and planned highways (corridor 8 and corridor 10, "Spatial plan of RM, 2004") (Figure 14) will be a potential obstacle for bear migration and cause fragmentation of its habitat. In the last few years a few bears have been killed (railway, near Veles) and several injured in traffic accidents on highways (State Environmental Inspectorate, MEPP).

Like other developing countries, Macedonia faces an electricity shortage. The government announced the Energy Strategy for using renewable hydropower, which means building new water dams. So far we do not know how water dams will act as barriers to bear movement, reproduction and feeding, but this will most likely depend on the size of the dam (accumulation).



Figure 14: Road infrastructure development and bear movement. Photo: “Spatial plan of the Republic of Macedonia 2002-2020”.

7.3. Human–bear conflicts

In order to form a clear picture about human–bear conflicts, the different human attitudes toward bears should be taken into account.

Due to the high migration rates during the 1950s to the 1970s from rural to urban areas and the parallel decrease in livestock breeding, human–bear conflicts have dropped considerably. Investigations showed that most people – especially permanent residents of rural areas – consider

bear damage as a “natural part of rural life” and do not perceive it as a threat (Arcturos, 2002). The percentage of people who complained is small but not realistic, as, for various reasons, bear depredation is not always reported.

The damage compensation system in Macedonia is not very efficient. Therefore, some livestock owners (farmers) would kill a bear if they suffered damage from it. In such cases, the livestock owners do not take damage prevention measures and most often the wrong bear is shot without official permission. This unreasonable act is considered to be poaching but is unofficially approved because it “compensates” for the damage caused by the bear and defuses the high-tension situation.

Hunters respect bear and lynx most. Their opinion is that bear should be strictly protected by law. However, most of them would kill a bear if the opportunity presented itself, despite their awareness of the consequences of this act (Arcturos, 2002).

Dancing bears have not been seen in the country for the last 30 years, but there are a few cases of illegal bear trading with the neighbouring countries (Arcturos, 2002).

Before the bear was protected, hunting associations kept books for bears shot in Macedonia and the data were published in statistical annuals of former Yugoslavia. This number varies from 114 in 1979 (maximum) to 14 in 1983 (minimum) (Figure 15).

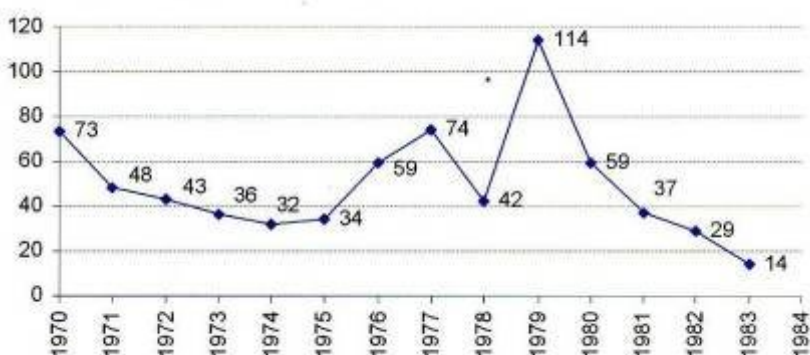


Figure 15: Number of Brown bears shot in Macedonia in the period 1970-1983.

The last official recorded data for bears killed are from 1994; with 27 legally shot animals only in the hunting season (Statistical Yearbook of the Republic of Macedonia, 1995).

Today it is hard to tell the real number of bears killed (poached, found dead, died in accidents), mainly because of the lack of coordination between related stakeholders (government, hunting federation, hunting societies, etc.). Statements from the local people and hunters and the reports we have from our network members are fearful and indicate that conservation measures should be undertaken.

Other threats that may influence bear distribution and abundance are: disturbance, overexploitation of forest fruits as primary bear food (blueberries, strawberries, raspberries, etc.), setting of poison bait to eradicate “pest” animals such as wolves, etc.

Further scientific work on the Brown bear in Macedonia will define more precisely the possible threats, or even discover new ones. Only by dealing with the threats one by one, can we ensure the bear’s existence and population expansion in Macedonia.

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